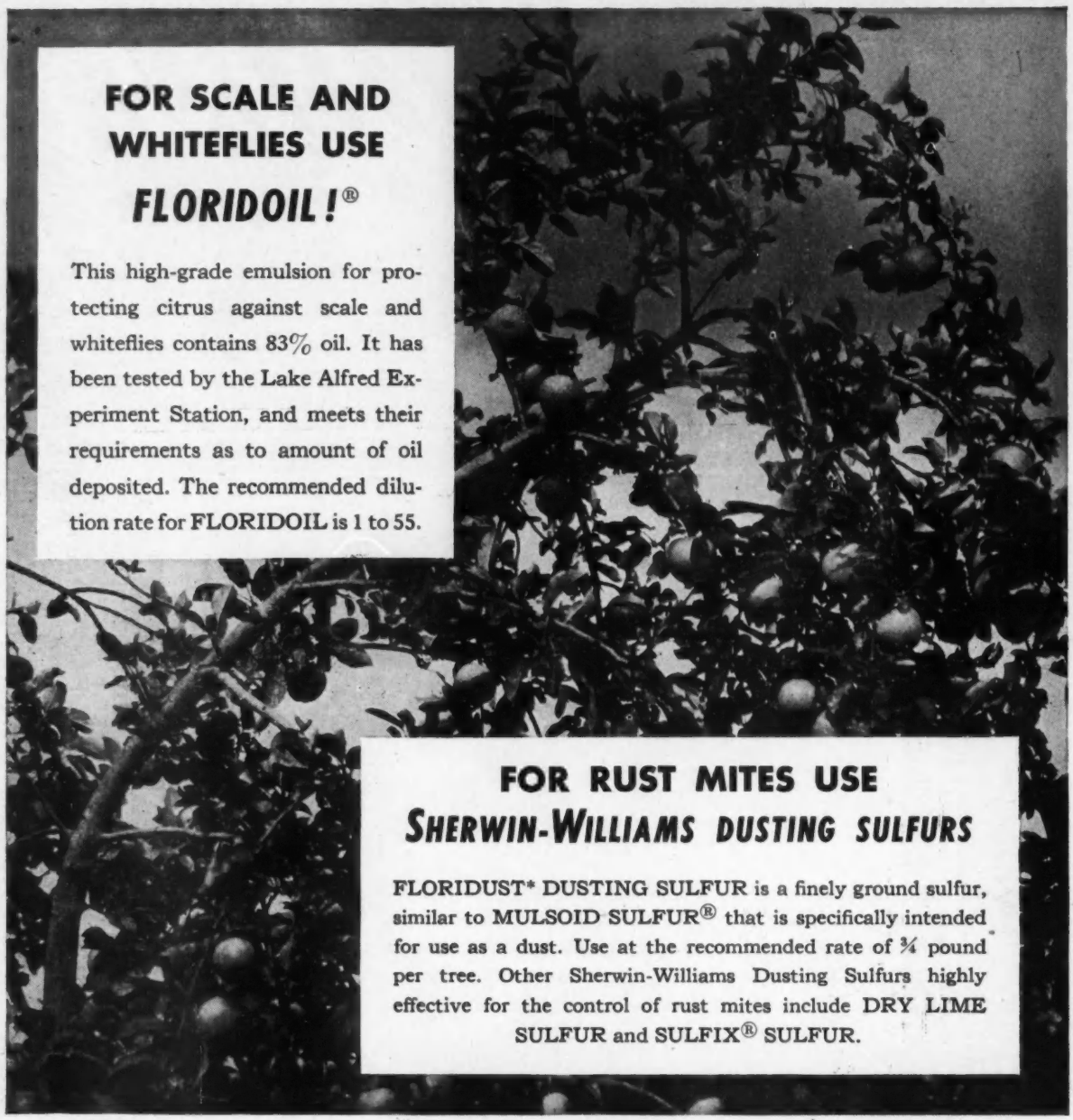
The Citrus Industry

J. L. HEID
Director Research and Development, Florida Citrus Canners Cooperative, Lake Wales

Vol. 29, No. 6 June, 1948



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AGRICULTURAL CHEMICALS

Heliocopter To Dust Citrus Grove

For the first time in the history of citrus culture in Florida, a heliocopter will be used to apply sulphur dust to more than 6,000 acres of grapefruit and oranges in the Winter Haven area for protection against insects.

The heliocopter, a Bell Aircraft Model 47-D, will be provided by Dixie Dusters, Inc., which has its headquarters there, and it will be flown by George C. Petrouleas, president of the firm.

"Bell heliocopters recently became the first rotary-wing aircraft licensed by the Civil Aeronautics Authority to dust with surphur," Petrouleas said, "and we're going to take full advantage of this opportunity to aid Florida citrus growers.

"With the heliocopter we can treat a minimum of 50 acres an hour, as compared with the 40 acres a day which can be covered by other types of equipment.

"Ability of the heliocopter to fly slowly and to hover motionless if necessary makes it an ideal aerial vehicle for applying agricultural dust of any kind."

Petrouleas will use his heliocopter as far south as Sebring, Fla, and as far north as Leesburg to treat the groves of some of the largest citrus growers in Florida. Dusting will begin in mid-July.

Dixie Dusters pioneered citrus dusting by aircraft in the Winter Haven area in 1946 and developed application techniques which proved aerial treatment to be economically sound.

Petrouleas flew his heliocopter away from the Bell Aircraft Corporation plant in Buffalo, N.Y., recently and was scheduled to arrive the next day in Quincy, Fla., where he will dust shade-grown tobacco for the first time with the rotary- wing aircraft.

CLUB MAKES MONEY

Members of the White City home demonstration club cleared $160 from sales of sandwiches, drinks, and doughnuts at a recent Gulf County political rally, according to Mrs. Wilma A. Revel, home agent. The money will be used in completing the community house.

Internal Fruit Quality As Related To Production Practices . . .

JOHN W. SITES

(Concluded from Last Month)

Potash Fertilization in Relation to Fruit Quality

The recommendations of the Citrus Station with regard to the use of potash were reviewed by Camp (1) in 1944. At that time responses from the variable potash applications to Block V at the Citrus Station were beginning to be observed in the quality of fruit produced but they had not been continued sufficiently long to make adequate interpretations of the results. The fertilizer treatments applied to this block are summariezd in Table 1. The potassium treatments are split into two series, A and B. Series A is identical with B except that no magnesium is supplied to any of the plots in this series. Symptoms of potassium deficiency have been more pronounced during the past few years, especially in the series B plot. In view of the fact that potassium in any form has been with-held from the zero potassium plot since 1939, it is interesting to note that potassium dificiency symptoms in these trees have only in the past two or three years developed into more advanced stages. No consistent leaf chlorosis pattern has yet been observed. The fruit from the deficiency plots is approximately two sizes smaller than from any of the other plots. This fruit is characterized by a thin rind, and is of excellent texture. Another characteristic of the deficient trees is premature dropping of the fruit. This begins in the summer so that much of the crop has been dropped by the time it is ready to be picked. Internal redistribution of potassium is known to occur readily and more or less continously from the older plant organs to the younger ones. This characteristic undoubtedly accounts for the relatively long period of time it has taken for definite deficiency symptoms to show in these trees.

Certain changes in the internal characteristics of the fruit as related to the potassium treatments have gradually been taking shape over a period of several years. The results of the analyses for 1946-47 have shown these changes more clearly in some respects than ever before, Table II. The most consistent changes in the juice of the fruit as the potash fertilization increased was an increase in the citric acid content. This increase occurred, however, only when magnesium was adequately supplied. Where magnesium was deficient the acid content of grapefruit juice showed no consistent increase above the 3 percent potash treatment.

Changes in the soluble solids content of grapefruit show a smiliar trend as was shown for juice acidity except that the influence of the potassium treatment is slightly less pronounced. In the B series, where magnesium is supplied, there was a fairly sharp rise in solids from the 0 percent to the 3 percent treatment and a gradual increase from the 3 percent to the 10 percent treatment. Where magnesium was deficient the solids fell off noticeably in the 5 percent and 10 percent treatments.

As would be expected, considering the relationship of the potassium applications to the acidity and soluble solids content of the juice, the ratio was much higher from the zero potassium treatment and decreased as the potash applications increased. Fruit from the O% potassium plot passed the 7.00 to 1 ratio by September 30, whereas fruit from the 10% potash plots did not pass until October 30 a month later. The other treatments were intermediate between these dates.

Differences in the amount of vitamin C in the juice of fruit as related to potassium applications show the same trend that has been discussed for soluble solids. In many cases of fruit analyses there has been observed a very close correlation between the development of soluble solids and the formation of ascorbic acid. The vitamin C increased in the B series plots with the increase of the potash application and showed a sharp increase between the O% and the 3% treatment. The seasonal aerages show the fruit from the O% plots contained an average of 35.8 mgs. of ascorbic acid per 100 mls. of juice while fruit from the 10% plots contained an average of 41.7 mgs., an increase of 14%.

Differences between treatments as to the volume of juice extracted were not significant.

The question has been raised in view of these results, whether it would not be advisable to cut down or leave out entirely the potash from the summer fertilizer application, the object being, in the case of grapefruit, to reduce the acidity and produce fruit which would pass legal maturity earlier in the season. There is the further possibility that a lower arsenic application combined with such a treatment might be effective and thus reduce the possibility of arsenic toxicity. On the basis of the past performance of these plots the evidence is against this idea working very satisfactorily. Kime (8) showed that potassium leaches out of most Florida citrus soils almost as rapidly as nitrogen. The present potassium applications were started in 1939; yet in spite of this fact there was little evidence of noticeable change in fruit quality before 1943, approximately four years later. It seems doubtful that the omission of or the reduction of potash in a single application is going to affect the internal quality of the fruit to any very marked degree. A single year's data on a set of plots started by Dr. B. F. Fudge and carried on in cooperation with the Haines City Exchange shows no indication to date that such changes in potash fertilization would be effective.

Timing of Oil Sprays Affects Fruit Quality

The extent to which the timing of the oil spray will affect internal fruit quality has been discussed on several occasions this year, but since it is especially important for early oranges, a very brief summary of our results is given to complete this discussion. Low solids delayed shipment of the fruit from many Hamlin and Parson Brown groves in 1946 and the

(Continued on Page 7)

The Citrus Industry
EXCLUSIVE SPECIALIZED CITRUS PUBLICATION
Issued Monthly
Representative of every interest
Representing no special interest

Publication office at Bartow, Florida. Entered as second class matter February 16, 1920, at the post office at Tampa, Florida, under the act of March 3, 1879. Entered as second class matter June 19, 1933, at the post office at Bartow, Florida, under act of March 3, 1879.

A Progress Report On Persian Limes...

By Edwin L. Moore, C. D. Atkins, and Eunice Wiederhold

During the 1942-43 season, preliminary experiments were carried out on the recovery of cold-pressed lime-peel oil by Atkins, Wiederhold and Heid (1). Their preliminary tests were made to determine the quantity of oil present in and obtainable from cull Persian limes, and included a comparison of extracting equipment and treatments in recovering the cold-pressed lime oil. These authors found that by use of a tapered-screw press around one-third of the oil present in the whole fruit was recovered as cold-pressed lime oil in a laboratory model Sharples Super-Centrifuge.

Work was done in the laboratory of the U. S. Citrus Products Station, Winter Haven, Florida, during the 1944-45 season to compare the efficiency of two methods of securing oil emulsions and the adaptability of these emulsions to yielding cold-pressed oil on centrifuging. During the 1945-46 season, some work was carried out with the Sharples Corporation on the recovery of cold-pressed peel oil. Because of the numerous requests for this information, it is the purpose of this progress report to summarize this experimental work.

Recovery of Cold-Pressed Persian Lime-Peel Oil in the Laboratory During the 1944-45 Season.

The object of this work was to compare the efficiency of two methods of securing oil emulsions and the adaptability of these emulsions to yielding cold-pressed oil on centrifuging.

Two tests were made on four bushels of cull limes, which were forwarded by express from Goulds, Florida to Winter Haven, Florida. The limes were received on the afternoon of December 3, 1944, and were held in 40°F. storage until the following morning when they were processed.

In both tests a Sharples Model T-41-23-8C laboratory steam-driven Super-Centrifuge, having an inside bowl diameter of 1¾ inches and equipped with either a No. 8 ring dam, (diameter 14/16 inch) or a No. 10 ring dam (diameter 15/16 inch) was used.

In extracting the peel-oil emulsions an Enterprise Press consisting of a tapered, stainless steel screw, which turned at about 300 r.p.m. in a nickel alloy case having a screen 15/16 inch wide and 12½ inches long with 5/32 inch perforations was used. The emulsions of lime-peel oil were prepared from unreamed and reamed fruit by passing through this screw press. The oil contents of the whole fruit and peel-oil emulsions were determined by the usual Clevenger steam distillation method.

In the preparation of the peel-oil emulsion from unreamed fruit, (Test 1), the whole limes were passed through the screw press, and the pressing residue again passed through the screw press. The press-juice emulsions from the two extractions were combined, screened, and centrifuged once at 36,000 r.p.m., using the No. 8 ring dam. The rate of flow of the emulsion through the centrifuge was about 400 ml. per minute. No cold-pressed oil was recovered.

In the preparation of the peel-oil emulsion from reamed fruit (Test 2), the reamed halves were passed through the screw press and a small quantity of water was added as the peels were fed to the press. The pressing residue was again passed through the screw press and a small quantity of water was add-

[1] This investigation was carried on at the U. S. Citrus Products Station, Winter Haven, Florida, with funds provided by the Florida Citrus Commission, Lakeland, Florida.

ed as the residue was fed to the press. The press-juice emulsions from the two extractions were combined, screened, and centrifuged once at 43,000 r.p.m., using the No. 10 ring dam. The rate of flow of the emulsion through the centrifuge was about 200 ml. per minute. Approximately 22 per cent of the oil present in the whole fruit was recovered as cold-pressed oil. In both tests, Dr. M. K. Veldhuis and Mr. G. N. Pulley of the U. S. Citrus Products Station assisted in operating the centrifuge.

The whole lime had an oil content of 0.35 per cent. Over 80 per cent of this oil was present in the screened emulsions prior to centrifuging. The centrifuged emulsions in Tests 1 and 2 contained 11 per cent and 6 per cent respectively, of the oil present in the whole fruit.

The 22 per cent recovery of cold-pressed oil in Test 2 was less than the 29 to 34 per cent yields reported by Atkins, Wiederhold, and Heid (1). The limes used in these tests however, were much riper than those used in the previous season. A considerable amount of suspended matter was encountered which rapidly filled the centrifuge bowl. It is possible that if some type of "desludging" centrifuge were used as a preliminary step, the recovery of oil might be improved. Also the best speed of centrifuging for recovery of oil together with rate of flow of emulsion through the centrifuge needs to be determined.

Recovery of Cold-Pressed Persian Lime-Peel Oil with the Sharples Corporation During the 1945-46 Season.

In April, 1945, a letter was sent to the Sharples Corporation, Philadelphia, Pennsylvania, asking for information on a small-capacity centrifuge capable of separating lime-peel oil from the juice and water emulsions. In a reply to this letter, the Sharples Corporation suggested that we send a sample of material to them for the purpose of making a series of tests in their laboratory to endeavor to learn just what type of unit would be most suitable for separating lime oil from water emulsions of the peel.

On September 11, 1945, a 10-gallon benzoated sample of a lime-peel-water emulsion was sent to the Sharples Corporation and received by them on September 20, 1945. The procedure used in preparing this emulsion was as follows:

From a lime-juice canning plant that used rotary juice extractors, 149 pounds of halved green peel was obtained. This peel was reasonably free of any remaining juice, and was used within 3 hours after obtaining the peel. The peel was passed through the Enterprise press previously described in this paper, and a total of 7½ gallons of water was added as the peels were fed to the press. The pressing residue was discarded and **not** repressed. The resulting emulsion was passed through a "Sep-Ro-Siv" screen with 0.030 inch perforations followed by screening through a 25-mesh stainless steel screen. To the screened emulsion, 0.2 per cent of sodium benzoate was added as a preservative, and then the mixture was packaged for shipment.

Oil determinations were made on the original peel and the lime-peel-water emulsion. The lime-peel-water emulsion contained 0.72 per cent oil by volume, which when calculated on a weight basis amounted to about a 65 per cent recovery of the oil present in the original peel. This 65 per cent recovery was obtained when the residue was discarded; whereas, an 80 per cent recovery was obtained in a previous test reported in this paper where the pressing residue was re-pressed.

On October 5, 1945, the Sharples Corporation sent to us their laboratory report No. A-4750 based on experimental work done on the lime-peel-water emulsion sent to them. The following three paragraphs are quoted from their report No. A-4750 on experimental runs 1, 2, and 3.

"Run No. 1 — A batch of 4,000 c.c. of lime-peel-water emulsion was run through the laboratory Super-Centrifuge, operated at 21,000 r.p.m., using a separator bowl with a No. 8½ ring dam, at a rate of 100 c.c./min. The resultant separated water appeared relatively clear as discharged but showed some precipitate after standing, although it appeared to contain no free oil. No oil was discharged but a definite quantity was accumulated in the bowl and came down with the bowl drainings. It was noted that there were only a few drops of free oil and the balance was in emulsion form. The solids removed as bowl cake amounted to approximately 1.5% by volume.

"Run No. 2 — A batch of 4,000 c.c of lime-peel emulsion was run through the laboratory disc centrifuge, equipped with a separator bowl at a rate of 150 c.c./min. The resultant separated water appeared clearer than that obtained on the laboratory Super-Centrifuge. Again there was no oil discharged since it was accumulated in the bowl. In this case the bowl drainings showed 8 c.c. of clear free oil with only a very small quantity of emulsion.

"Run No. 3 — The bowl drainings from Run No. 2 and the remainder of lime-peel emulsion was centrifuged on the laboratory disc machine at 150 c.c./min. for oil recovery. In this case there was a sufficient quantity of oil for continuous discharging. The resultant separated oil was clear and amounted to 60 c.c. from a total feed of 31,200 c.c or 0.192%."

Based on the 0.72 per cent oil by volume of the lime-peel-water emulsion, this 0.192 per cent recovery of oil amounted to about a 27 per cent recovery of oil based on the total present in the lime-peel-water emulsion. This recovery of oil is of the same order of magnitude as that obtained by the authors under laboratory conditions during the 1944-45 season.

Reference

(1) Atkins, C. D., Wiederhold, E., and Heid, J. L.—The Recovery of Flavoring Oil from Persian Limes —Preliminary Experiments.—Fruit Products J. Vol. 23, pp. 306-308, (1944).

PAPER BAGS FOR CITRUS SHIPMENTS

Executives of the St. Regis Paper company, together with W. H. Palmer, of Ocala, state distributor for St. Regis products, entertained a group of citrus factors at Waverly Growers one day last week where they demonstrated the new St. Regis paper bag which for the first time is being used as a container for citrus fruit.

A specially designed machine built by the company was in operation and the visitors were shown the plant in operation as it sacked oranges and grapefruit.

At noon the guests were entertained at a banquet at the Walesbilt Hotel in Lake Wales, following which the company executives gave an illustrated presentation of the advantages of the new bag container.

INTERNAL FRUIT QUALITY AS RELATED TO PRODUCTION PRACTICES

(Continued from Page 4)

same thing is happening again this year. All of this trouble cannot be attributed to improper timing of the oil sprays. Where the timing was poor, the condition was made considerably worse. In general, trends for the early oranges are similar to those reported earlier (13) for Pineapples, but the immediate effect to the grower, may in contrast, be very different. The market is usually best for Hamlins early in the season. Meeting color-added maturity standards then becomes paramount for Hamlins and Parson Browns, whereas this is generally not a serious problem for Pineapples or Valencias; their quality is reduced by improper timing of oil sprays but the fruit can still be shipped. Serious reductions in solids in early oranges, however, may result in the fruit never meeting minimum solids standards or at least not until late Internal fruit quality as related to production practices -- .... in the season. Of particular importance as shown by the results of several seasons are the following points:

1) The best time to apply single, straight oil sprays to Hamlin oranges is between June 1 and July 15.

2) Oil sprays applied August 1st and later cause lower solids than those applied during June and July.

3) All double oil sprays reduce solids more than early single oil sprays.

4) A proprietary copper - oil applied in early April and followed with a straight oil in June or early July has resulted in higher solids than other double oil sprays.

5) Straight oil applied June 1 and followed with a second application July 15 is better than any other combination where straight oils as double sprays are used.

6) Double oil sprays for Hamlin oranges should not be used unless the scale infestation is especially serious. In such cases, a copper-oil applied at melanose time followed by a straight oil in June or early July is preferable. Where two straight oils are used, the June 1—July 15 combination or a close approximation of these dates has given best results.

)7 Double oil sprays requiring the second oil to be applied during the months of August and September should not be used for early oranges, the reduction in solids is too great.

In general these same statements apply to other orange varieties and to grapefruit. Grapefruit, however, is somewhat less responsive to oil treatments than oranges. Double oil sprays applied during August and September will result in lower solids fruit, but the effect from single applications of oil sprays during August and September generally does not cause as much reduction in solids for grapefruit as for oranges.

The best way to obtain good fruit quality is to maintain good tree condition. With the possible exception of arsenic for grapefruit, there is no good reliable short-cut to early maturity or high quality fruit. Location, weather conditions, root-stock, and the gentic constitution of the bud wood are all important factors in determining quality but are factors over which the grower has little control. Beyond this, careful attention to the spray program and the selection and careful following of an adequate and suitable fertilizer program which will maintain the grove in good physical condition is the best and most satisfactory way to insure production of high quality fruit.

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TABLE 1
Fertilizer Treatment for Potash Experimental Plots—Block V.*

SERIES A

Plot No.	N%	P2o5%	K2o%	MgO%	MnO%	CuO%
1 & 3	3	6	3	0	1	½
2 & 4	3	6	10	0	1	½
5	3	6	5	0	1	½
6	3	6	0	O	1	½

SERIES B

Plot No.	N%	P2o5%	K2o%	MgO%	MnO%	CuO%
1 & 3	3	6	3	3	1	½
2 & 4	3	6	10	3	1	½
5	3	6	5	3	1	½
6	3	6	0	3	1	½

* Plots receive 3 applications per year of the above mixtures at the rate of 15 pounds per tree per applications. All plots receive a dormant nutritional zinc spray, 3 pounds $ZnSO_4$ per 100 gallons.

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UMI Opens New National Training Center

Selected employees of wholesalers will be given intensive course at Kansas City to fit them to teach retailers.

In order to multiply the effectiveness of its present program of training retailers in improved methods of merchandising fresh fruits and vegetables, the United Fresh Fruit & Vegetable Association's UMI (United Merchandising Institute) has opened a new training center at Kansas City.

This center will train carefully selected employees of wholesale produce houses as instructors. These men will, in turn, teach retailers how to merchandise fresh fruits and vegetables in such a way as to increase sales, reduce spoilage, and improve dollar profits.

Up to this time UMI has sent out its own instructors to train retailers directly. These instructors are paid by the U. S. Department of Agriculture under a contract with the Association, under terms of the Research and Marketing Act. The Department is evaluating the possibilities of increasing fresh fruit and vegetable consumption through teaching retailers improved merchandising techniques.

The results have been highly satisfactory, according to C. W. Kitchen Executive Vice President of the United Fresh Fruit & Vegetable Association. He states that retailers and wholesalers report considerable in-

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TABLE II

Maturity Analysis of Duncan Grapefruit as Affected by Varying Applications of Potash.

Minus Magnesium (Series A)

Sampling Date	% Citric Acid				% Total Soluble Solids				Ratio			
	0% K20	3% K20	5% K20	10% K20	0% K20	3% K20	5% K20	10% K20	0% K20	3% K20	5% K20	10% K20
Sept. 17	1.06	1.38	1.30	1.40	8.65	8.63	8.05	8.26	8.16	6.27	6.19	5.87
Sept. 30	0.99	1.29	1.25	1.25	8.55	8.58	7.93	8.10	8.68	6.68	6.34	6.50
Oct. 15	1.15	1.20	1.22	1.26	8.65	8.59	8.35	8.35	7.52	7.18	6.87	6.69
Oct. 30	1.09	1.18	1.15	1.16	8.80	9.13	8.40	8.75	8.11	7.74	7.34	7.66
Nov. 12	0.915	1.15	1.14	1.18	9.20	9.47	8.90	8.87	9.89	8.32	7.81	7.56
Seasonal Average	1.04	1.24	1.21	1.25	8.77	8.88	8.33	8.47	8.47	7.24	6.91	6.84

Difference Necessary for Significance Between Potash Treatments

	% Citric Acid	% Total Soluble Solids	Ratio
5% level	.134	.460	1.056
1% level	.181	.620	1.424

Plus Magnesium (Series B)

Sampling Date	% Citric Acid				% Total Soluble Solids				Ratio			
	0% K20	3% K20	5% K20	10% K20	0% K20	3% K20	5% K20	10% K20	0% K20	3% K20	5% K20	10% K20
Sept. 17	1.16	1.28	1.31	1.42	8.05	8.43	8.25	8.66	6.94	6.61	6.30	6.16
Sept. 30	1.05	1.22	1.05	1.34	8.25	8.43	8.38	8.58	7.86	7.93	6.59	6.40
Oct. 15	1.05	1.14	1.15	1.30	8.35	8.60	8.65	8.78	7.99	7.53	7.52	6.73
Oct. 30	0.97	1.12	1.19	1.29	8.80	9.20	8.90	9.40	9.07	8.24	7.48	7.30
Nov. 12	0.845	1.05	1.13	1.19	8.65	9.26	9.20	9.44	10.24	8.89	8.14	7.97
Seasonal Average	1.015	1.16	1.21	1.31	8.42	8.79	8.68	8.96	8.42	7.63	7.21	6.89

Difference Necessary for Significance Between Potash Treatments

	% Citric Acid	% Total Soluble Solids	Ratio
5% level	.120	.508	1.162
1% level	.162	.684	1.566

Use Of An Anion Exchange Resin

In The Preparation Of Syrups From Orange And Grapefruit Juices

HERBERT C. GORE
In Fruit Products Journal

Methods for the preparation of clear low acid syrups from orange and grapefruit juices are of interest because such processes, if successful, will provide new avenues of use for citrus fruits. It has been found recently (2) that well flavored, well colored and reasonably stable clear syrups may be readily prepared on a laboratory scale using open kettle methods of concentration. In this work, the use of bases for partly neutralizing the acids was found to have certain disadvantages. An alkali metal base, such as sodium carbonate, must be used with great care to avoid the deleterious effects of local excesses. and acrid flavors are found in the neutralized syrups if more than very small percentages of acid are present in the juices being treated. Use of calcium carbonate avoids these difficulties. However the calcium salts formed in the juice do not separate promptly, the hot evaporator surfaces become coated with soft adherent deposits of calcium salts and the syrups have to be refiltered after a period of storage to remove the calcium salts which continue to separate on standing.

It is well known that a synthetic anion exchange resin, now available commercially, may be used for the removal of acids from solution, the absorptin taking place without the formation of salts. That the resin has already found extensive use is shown by the bibliography of 20 papers listed by the manufacturers. (4). It seemed worth while to try it in the removal of acid from the citrus juices, and accordingly the data given below were obtained.

The resin used is known as Amberlite IR-4B. Although somewhat expensive, its cost is offset by the fact that after use its absorption activity is easily regenerated and it may be used over and over again indefinitely. Of the two methods of using the resin in current use, the column method and the batch method, the latter only was used in the work here reported.

In using the resin the juice to be treated was mixed at room tem-

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*Paper delivered at the 112th Meeting of the American Chemical Society, New York, N. Y., Sept. 17, 1947.

The Citrus Industry

with which is merged The Citrus Leaf
Exclusive publication of the Citrus Growers and Shippers

Publication Office 550 North Broadway, Bartow, Florida
Telephone ——— 248

Published Monthly By
ASSOCIATED PUBLICATIONS CORPORATION

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Subscription, $1.00 per year in advance
Outside Continental United States, $2.00 in advance

THE GROWER'S RESPONSIBILITY

As pointed out by Dr. J. L. Heid in an article elsewhere in this issue, the ills which beset the citrus industry are primarily the concern of the growers themselves. Growers must accept this fact and set about solving their own problems. It has been popular to place all the blame on the packer, the shipper, the canner, the wholesaler, the retailer and anyone else even remotely concerned with the handling or movment of the fruit. Doubtless some of this criticism is justified, but the grower cannot escape his own responsibility—it is his grove and his investment; he is more vitally concerned than any other factor.

The packer cannot pack immature or inferior fruit unless the grower first supplies him with such fruit; the shipper cannot ship immature or inferior fruit unless the grower permits such fruit to leave his grove. If the grower observes proper cultural methods to produce only high grade fruit; if he withholds from the market all inferior fruit, the packer, the shipper and the canner will, perforce, find no other fruit to handle and the consumer will no longer be paying $2.00 a box more for California oranges than for the Florida produced article.

The first step of the Florida grower, and the one most essential to himself, is the production of QUALITY fruit; the next is the withholding of all inferior fruit from the market; the third is organization to see that QUALITY fruit is properly marketed, and the fourth is the encouragement of research workers to develop new uses and new outlets for their fruit.

Too many growers have gone on the theory that their part ended with the production of the fruit—any kind of fruit—and let the research workers develop new uses and the marketing agencies new outlets. To protect his investment, the grower must become more than a grower—he must concern himself with the research which is being carried on, he must study for himself the creation of new outlets, he must organize to control distribution, he must realize that his responsibility is not completed when the fruit is clipped from the tree, but that it extends to the table of the ultimate consumer.

That many growers are recognizing this is shown by the interest which is being taken in the organization of the Florida Citrus Mutual and other movements now going forward to bring growers together in other matters outside the purely cultural practices of producing the fruit. Never before in the history of citrus production in Florida has there been such general realization of and necessity for the need of concerted and united action on the part of growers—in all matters pertaining to the industry, from the planting of the trees to the final disposition of the fruit, whether that be on the tables of the nation or in the glass at the vendor's stand.

One thing is certain—Florida citrus growers are aroused as never before to the pressing need for united action to help solve ALL the citrus ills.

COMMISSION ACTS TO IMPROVE QUALITY

Acting upon recommendations made by a grade committee, the Florida Citrus Commission has approved changes in grading which it is hoped will result in a higher internal quality of fresh citrus fruits shipped out of the state.

If the suggested changes are accepted by the United States Department of Agriculture, no oranges may be shipped out of state that do not pass the Grade "A" test for juice content, thus raising the internal quality. Designed to hold back much of the early season fruit which has given rise to much criticism in Northern markets, the change should result in much better tasting oranges—certainly a most desireable achievement.

Heretofore, the Grade "A" juice standard has been merely a permissive grade, which shippers were permitted to stamp on their boxes, when the fruit meets the requirements. If the changes are accepted by the Federal Government, meeting of this requirement becomes obligatory.

Another important change approved by the Citrus Commission is the elimination of the "combination" grade on oranges, grapefruit and tangerines, and the substitution therefor of No. 1 and No. 2 grade. Color and other external factors for the new No. 1 and 2 grades also were approved. Under present regulations most of the fruit shipped from interior points went forward under the "combination" rating.

Texas will be asked by the Agricultural Department to study the suggested changes, and if the reaction there is favorable, the Department is expected to go ahead with its approval. If the Texas reaction should be unfavorable, the Citrus Commission may then seek a separate standard for Florida, similar to that now in effect in California.

While the action of the Citrus Commission in giving its approval to the suggested changes was not unanimous, it is the belief of many in the industry that it is a long step in the right direction, insuring as they do a nearer approach to the "taste test" which many growers and shippers have been advocating.

USE OF AN ANION EXCHANGE RESIN IN THE PREPARATION OF SYRUPS FROM ORANGE AND GRAPEFRUIT JUICES

(Continued from page 9)

perature with about 5 per cent resin, and the latter kept in suspension in the juice for a short time. usually about an hour. During this time large perecentages of the titratable acids present were absorbed, very rapidly at first, the absorption rate slackening toward the end of the treatment. The resin, which was 30 to 50 mesh, settled readily when the stirring stopped. The juice was then decanted, filtered, and evaporated to syrup. The evaporation took place in flat-bottom pans made of aluminum or stainless steel, using gas as fuel. Concentration up to about 70 per cent solids was readily effected without burning, and with only slight development of color, the juices remaining clear.

The used resin was regenerated by steeping in 4 per cent solution of sodium carbonate followed by rinsing with water.

The above process of removing acid by absorption followed by the regeneration of the absorbent, is simpler than cooking the juice with chalk followed by the necessary operations to remove calcium salts. Whether the column or the batch process of using the resin will be preferred in production scale work remains to be decided.

The clear beautifully colored syrups readily obtained from orange juice by the above process are sweet and well flavored. Similar syrups prepared by the same method from grapefruit juice are less attractive due to the presence of a bitter taste believed due to traces of naringen. Both orange and grapefruit syrup seem quite stable with respect to flavor, keeping for weeks at room temperatures without appreciable flavor changes. They darken appreciably with age if kept at room temperatures. Their color changes, however, are extremely slow at refrigerator tempeatures. Below is given a description of a typical experiment made on the preparation of syrup from fresh orange juice. The oranges used were California Valencias purchased on the local market.

The juice was obtained by the use of an aluminum burr and strained through cloth. Its Brix (20 degrees C.) was 11.1. The

yield of strained juice was 48.7 per cent of the weight of the fruit. A lot of this juice weighing 1414 g. was mixed with 5 per cent of air-dry Amberlite resin IR-4B, and stirred at 24 degrees C. for a total period of 1¼ hours using a small power driven stirrer having a chromium plated propellor. Samples were taken every fifteen minutes by dipping. pouring each sample on a screen surface and analyzing the strained juice for acidity (3) and ascorbic acid content, (1). The data are shown below.

Showing Absorption of Acid as Citric and Ascorbic Acid from Orange Juice by 5% of Amberlite IR-4B Anion Exchange Resin.

Interval Minutes	Acid as Citric g/100 ml	% absorbed	Ascorbic Acid mg/100	% absorbed
0	0.86	—	48.6	—
15	0.47	45	43.0	11.5
30	0.31	64	41.0	15.6
45	0.24	72	41.0	15.6
60	0.20	77	40.0	17.7
75	0.18	79	39.0	19.8

Thus nearly 80 per cent of the titatable acid was absorbed during the 75 minutes stirring with 5 per cent of the resin. Less than 20 per cent of the ascorbic acid was absorbed at the same time.

At the end of the run the juice was poured off, mixed with 12 per cent of the Hyflo Super Cel, and filtered on a precoated filter in a Buchner funnel. After standing in a refrigerator over night the filtered juice which had a pale greenish yellow color, was analyzed for acidity (found 0.1 of 1 per cent of acid as citric per 100 ml.) and ascorbic acid (found 32.4 mg. per 100 ml of ascorbic acid.) It was then evaporated to syrup. The solids content of the syrup (by Brix Table from its specific gravity at 20/20.) was 64.4. It contained 0.64 per cent of acid as citric, and 178 mg. per 100 g. of ascorbic acid. A substantial proportion of the original ascorbic acid thus appeared in the syrup. Canned orange juice and grapefruit juice either fresh or canned gave similar results.

Summary

The above work shows that by use of an Anion exchange resin it is practicable to remove large proportions of the titatable acids from orange and grapefruit juices, the process used consisting of stirring the fruit juice and the resin together for a short time at room temperature, followed by allowing the resin to settle and decanting the juice.

The bland orange juice thus prepared. if filtered and boiled to syrup, formed clear, well flavored and well colored syrups. The syrups formed from grapefruit juice were similar except that they possessed bitter tastes. The ascorbic acid originally present suffered slight losses during treatment with the resin and slight additional losses during the evaporation to syrup.

References

(1) Determined by titration with 2.6-dichlorophenolindophenol.

(2) Gore, H. C., Studies on the Preparation of Syrups from Oranges and Grapefruit. Fruit Products Journal and American Food Manufacturer, 26, 301; 313, (1947).

(3) Methods of Analysis A. O. A. C., 5th Ed. (1945).

(4) Resinous Products & Chemical Co., Phila., Pa. "The Amberlites."

NEW EDITION OF CITRUS HANDBOOK

A revised edition of **The Color Handbook of Citrus Diseases** by L. J. Klotz and H. S. Fawcett will be available on June 17, according to an announcement from the University of California Press ($6.00).

Eleven new color plates have been added, making a total of 51 colored illustrations, and many changes have been made in the text. The loose-leaf handbook provides citrus growers and others in the industry with a ready means of identifying the various citrus diseases in the field.

Those owning a copy of the earlier edition, which was published in 1941, may secure a packet of the new material in loose-leaf form for $2.50. L. J. Klotz, one of the authors, is Associate Professor of Plant Pathology and Associate Plant Pathologist at the Citrus Experiment Station, Riverside, California, and the other author, H. S. Fawcett, is Professor of Plant Pathology and Plant Pathologist at the Experiment Station.

The Citrus Industry, Volume I, History, Botany, and Breeding, ($10.00) by Herbert John Webber and Leon Dexter Batchelor has been reprinted and is now available. Its 1,000 pages summarizes the most important information on citrus history and botany in relation to commercial production. Volume II of The Citrus Industry, The Production of the Crop ($10.00) will be published on November 1, 1948.

UMI OPENS NEW NATIONAL TRAINING CENTER

(Continued form page 8)

creases in sales, retailers showing increases averaging around 30 per cent and ranging upward to 100 per cent and more. Under the present program, UMI is training about 1,000 retailers a month. No charge is made to retailers for this service.

However, the present program is strictly limited by the number of competent instructors who can be employed and put in the field to conduct classes. Each instructor can handle about eight to ten students a day, four days a week, or about 160 a month. Larger classes are not practical under this setup because each student takes part in the demonstrations. This takes time, but is one of the most effective educational methods.

The new center will permit training of as many instructors as the trade needs. For a fixed fee any member of the UMI can send an employee to the center for a two-weeks' course in both merchandising and how to teach merchandising of fresh fruits and vegetables.

Alan T. Rains, director of UMI, has announced that Charles Martin, an experienced UMI instructor, will be in charge of the training operation. After being trained at the center, new teachers will be given help on their home grounds by a UMI supervisor, until it is felt they are ready to handle classes unassisted.

The wholesalers who are sending men to the training center agree in advance with UMI that their own private classes will follow the UMI pattern. In this way, classes given by wholesalers all over the country will feature the same effective methods that are used in classes taught by UMI-employed men.

Grocers who want the controlled UMI course in their areas should consult their wholesalers.

For every dollar invested in biulding rural co-op power systems, consumers spend $4.50 on wiring and equipment.

To Prevent Plant Pests

Recent discovery in the territory of Hawaii of an introduced species of fruit fly known as Dacus dorsalis and the presence there of the citrus canker disease has required a revision of the federal quarantine against the Mediterranean Fruitfly and Melon Fly to regulate the movement from Hawaii of all fruits and vegetables and several additional products to prevent the spread to other sections of the United States of these and other dangerous insects and plant diseases, according to an announcement of Acting Secretary of Agriculture N. E. Dodd. The revision will be effective June 24.

There are, in the revision, many additions to the list of fruits and vegetables that may be certified after plant quarantine inspection. At the same time bananas have been withdrawn from the list since Dacus dorsalis attacks banana fruit at the stage of maturity at which they are ordinarily cut for shipment.

In order to cope with the possibilities of spreading plant pests by airplane movement from Hawaii, additional safeguards have been prescribed affecting the air movement of host material as well as the movement of planes that might accidentally carry such pests.

Other products affected by this quarantine are citrus peel, rice straw, mango seeds, and cut blooms or leis of gardenia and muana loa.

HAIRY INDIGO AN EXCELLENT COVER CROP

Hairy indigo is a versatile crop which is responsible for its growing popularity among Marion County farmers and throughout the state, says Carl Hendricks, County Agent of Marion County. It is an annual summer legume that may be used as a cover crop, grazed or cut for hay. As a cover crop it stores nitrogen in the soil and makes a heavy growth to be turned under. When grazed before it matures, it sends out new growth which affords additional grazing. When cut at proper stage of growth, it makes a palatable and nutritious hay. It grows well on almost any well drained soil. It may be planted through June. In this area it seeds profusely and the seed are harvested with combines.

Mr. Hendricks says that 4-5 pounds of seed per acre is sufficient to produce a good stand. As the seeds are small they should not be covered over ½ inch. By sowing the seed on top of freshly plowed or disced soil and rolling with a cultipacker or a leg a good germination can be expected. By sowing in middles of citrus groves it makes an excellent cover crop for supplying humus and nitrogen for the trees.

The Complete Utilization Of Citrus Crops

A discussion by J. L. Heid, Director of Research and Development, Florida Citrus Canners Cooperative, Lake Wales, Florida.

Prepared for the Third Annual Texas Chemurgic Conference, Corpus Christi, Texas, April 2, 1948.

A more timely moment could not be found for considering the Chemurgic utilization of oranges and grapefruit. Within the past week your speaker observed grapefruit being marketed at a gross mark-up of, not 49 per cent or 499 or 4,999, but 49,999 per cent over the price paid to growers of the fruit.

In New York hotels, grapefruit halves were served for $0.25, equivalent to $0.50 for each fruit. At the same moment growers were being paid as little as one tenth of one cent each for grapefruit. The fact that consumers paid five hundred times as much as growers received would be less important if growers' returns equaled production costs. If the grower had received his production cost, the mark up for picking, packing, delivering and serving would have only been reduced from $0.499 to $0.495, which could hardly have worked a hardship on the waiter, restaurant, jobber, transportation company, shipper, or picker.

This extreme instance was selected to emphasize two facts: first, that there is such a large discrepancy between returns to growers and prices charged consumers as to discourage increased consumption, and second, that growers must give serious consideration to stabilizing markets unless they can afford to grow citrus fruit as a charitable enterprise.

Chemurgic utilization of grapefruit and residues can be made to play an important role in stabilizing the marketing of citrus crops. A review of the general situation will indicate why this is true. During the war, citrus canners and concentrators were required to turn over much of their production to government agencies. Fruit plantings were increased and processing facilties were expanded. When government purchases were terminated, the industry woke to a realization that supply had been cultivated but not demand. The consuming public reacted normally to the slight.

Returns to growers for grapefruit dropped to as little as twenty per cent of production costs. Additional plantings offer the prospect of substantial and continuing increases in supply, but carry no assurance of corresponding increases in demand. Growers may wish for wind storms or freezes (for the other fellow), but it may be doubted that they are warranted in depending upon the whims of nature to maintain profitable markets for citrus crops.

With South Texas bank deposits at an all-time high, it is easy to reflect that constructive progress has been made in developing citrus markets and conclude that current reverses are temporary and will clear automatically. The facts do not warrant such wishful thinking.

Suggestions on how to improve markets are not lacking. On the contrary, virtually every grower, shipper, canner and politican, whether an old timer or a new comer, has ideas which he will expound at the drop of an auction price. As you may now bear witness, technical men of the industry are not immune to the temptation to probe for weaknesses. Ideas from every quarter are needed to understand all phases of problems, but the trouble is that ideas alone are not enough. If citrus growers want to stabilize the sale of oranges and grapefruit as industrial materials and as staple basic foods which no other available food can replace in our daily diets, growers must realize that it is their investment at stake and no one can protect them from their own mistakes or indifference.

Ideas, however good and sound, are not enough. United action must be taken by growers to provide realistic, enforceable regulation, plus a flexible, competent and honest organization for dealing with ever-changing problems which arise. Neither your speaker nor anyone else can provide a magic formula — a permanent cure for all headaches. Problems change so rapidly and unpredictably that growers can only hope to solve them by supporting an equitable, intelligent, and agressive organization to continuously:

A. Survey problems whch arise to determine their nature.

B. Analyze reasons for the occurence of dfficulties.

C. Develop and apply remedies, promptly, impartially, and effectively. Ideas, surveys and analyses alone are not sufficient unless enforceable remedies are developed and applied. Chemurgy offers opportunities for improving citrus markets provided developments are constructively applied to fit needs which arise. What is meant can be illustrated if typical problems are considered before specific technological possibilities are described.

Problems selected as illustrations are:

1. Market prices for fresh and canned oranges and grapefruit have reached levels which will not return fruit production costs to growers.
2. The market for fresh and canned grapefruit will not absorb the crop.
3. Buyers of canned citrus juice will not purchase more than current requirements regardless of brand or price.
4. Cannery residues, in the form of Dried Pulp or Final Molasses, the more difficult to sell at lower prices than inferior feeds which have been marketed for a longer period.

Considering these selected problems briefly:

1. Market prices for fresh and canned oranges and grapefruit won't return fruit production costs to growers.

A. Survey: At retail as low as nineteen cents each, for forty six ounce cans, grapefruit juice costs consumers half as much as soda water (at six ounces for a nickle). While soda pops are acceptable substitutes for fruit juices on a basis of flavor and have similar, pleasant thirst quenching properties, - there the comparison must end. Carbonated beverages are flavored and colored sugar-water

with no food value excepting their sugar content.

By contrast, orange and grapefruit juices are not only pleasant, refreshing thirst-quenchers, but are also our richest food sources of three vitamins: Ascorbc acid, citrin, and Inositol, and are good sources of many water soluble factors including Thiamin, Riboflavin, Niacin, Pantothentic acid, Biotin, Pyridoxin, as well as of naturally balanced minerials, all essential for developing normal teeth, bones, livers and capillary blood vessels, and for maintaining resistance to infectious diseases.

The quanity of soda water sold each year is more than twice the volume of the juice of all oranges and grapefruit grown in the United States despite the fact that the substitution of deficient foods is paid for by impairment of dental and general health, particularly during hot weather, when the losses are greatest and consumption of cooling beverages it at a maximum. We of the citrus industry stand convicted of being poor salesmen if we cannot sell as much of an incomparably superior product at an equal price. It seems logical to try to determine why such a situation should exist.

B. Analysis: Citrus growers may advantageously consider the success story of soda water as a clue to how some of their difficulties might be overcome. Among the reasons of the success of the soft drink industry are the products are sweet and uniform and are easy, convenient and profitable to serve. A high percentage of gross income is devoted to effective advertising.

In contrast, facilities for promoting, distributing and serving citrus juices in competition with soft drinks have been so poor that during the war when the shortage of sugar emptied the soft drink coolers, the citrus industry missed its golden opportunity to appease the thirst of a public which futilely ransacked those coolers for something sweet and cold to drink.

The nutitional value of citrus juices has not been adequately exploited. The quality of citrus juices, or imitations served as citrus juices, has often left much to be desired from a standpoint of uniformity and flavor appeal. Poor quality canned juices from early fruit are offenders in this sategory. Concoctions mixed in alleys from ancient beverage bases (plus a few ground oranges) distributed to restaurants in second-hand gallon jugs and served as orange juice have turned potential customers twoard inferior, but dependable soda pop.

Appropriations for promoting the sale of citrus fruits and products haven't always been invested to best advantage to meet current needs. Recently an advertiser used the back page of one of our most widely circulated national magazines to proclaim handsomely in five colors that even a baby could distinguish his oranges by scrutinizing the peel and counting the seeds. To which the consumer conceivably responded: "SO WHAT?" At best it may be doubted if he felt a strong urge to rush out and buy oranges of the advertised or any brand.

While it may gratify our pride to call attention to distinctive features of varieties we happen to grow, with the market situation in bad shape it might be profitable to consider whether the cost of such advertisement might not be invested more advantageously in timely promotion aimed realistically at the problem of making the public realize that oranges and grapefruit in fresh or canned form are the greatest bargain in today's food market and that every consumer would be better off physically and financially if he would triple the quantities which he consumes.

A slogan, such as "SIX TO SIXTEEN" could be used to promote realization that six to sixteen ounces of citrus juice are needed by every man, woman and child, every day for optimum development and health, and no pill, powder or other food can replace citrus fruit any more than citrus can replace other basic foods such as vegetables or dairy products.

One obstacle confronting growers who cannot afford to produce citrus fruit for fun is shared by producers of other basic foods. In this, the best fed nation in the world, more than half of us suffer from "Hidden Hungers" which impair health, development and resistance to diseases and shorten lives. This is caused not by a shortage of natural foods, but substitution of excessive quantities of highly refined foods, a situation called "faulty eating habits" by nutrition experts. Citrus fruits are one of the indispensible basic foods which can offset damage done by our addiction to excessive quantities of refined foods. Every means for forcing a general realization of this fact offers opportunities for improving our national health and the economic status of this industry. Probably the most effective promotional venture in this field is a colored motion picture planned and produced by A. J. Lorenz of the California Fruit Growers Exchange. It has been shown to 150,000 individuals engaged in teaching or practicing medicine, dentistry, nursing, dietetics and allied professions. It forcefully illustrates the value of adequate supplies of citrus fruits for promoting the rate and strength of wound healing.

In this film, two groups of guinea pigs are shown, raised on diets identical except for the inclusion or exclusion of citrus juices. Animals from each group are subjected to operations for removal of a portion of the stomach wall and then allowed to convalesce for ten days. Then the strength of healing of the stomach wall and abdomen are measured before the camera, revealing tremendous difference.

Similar motion picture demonstrations can be mede demonstrating the effect of citrus juice upon bone fracture healing as well as upon the development and health of teeth, gums and capillary blood vessels.

Much publicity has recently been given to external factors influencing tooth decay. Fluorides in drinking water or swabbed on teeth slow decay. Fluorine is a poisonous antiseptic with a chemical affinity for the calcium phosphates of the teeth. Unfortunately, too, little is ineffective and too much, as has been dmonstrated by Walter Wilkins in New Mexico, and is proclaimed by the American Medical Association Handbook of Nutrition, darkens and softens the teeth so that they are rapidly worn away by chewing. At very best the use of fluorine might be compared to using aspirin to mask the pain of a headache instead of seeking to remedy the cause.

A clue to the remedy can be found among the eskimos who suffered few dental troubles while they subsisted wholly upon natural foods. Given flour, sugar and other refined foods, they quickly became the worst sufferers because they had no foods sufficently rich in calcium, phosphorus and Vitamin C to offset the deficiency of the refined foods. A combination of milk, citrus juices and fish liver oils (or irradiated foods) is rich in the factors essential to the development of normal, strong disease-resistant teeth in healthy gums. By visual demonstration of such facts to individuals in a position to influence eating habits, the citrus industry can accomplish a maximum of promotion with minimum time and expense. It has been demonstrated that lectures describing the nutritional benefits of citrus

to women's and civic clubs can appreciably stimulate sales in a community.

The beverage field offers tantalizing possibilities for increasig citrus consumption. With inherent superiorities of flavor, food value and refreshing quality, orange and grapefruit juices are naturals for skillful promotion in this field. A difficulty in the past has been that costs of distribution in bottles have been so high that the industry has considered it impossible to profitably market anything but flavored sugar water for a nickle.

Now with competition from vending machines, it is certain that ades, containing 25 to 50 per cent of juice, can invade the nickle beverage field. For ten cents vending machines can dispense finest reconstituted frozen orange concentrate, equal in flavor and food value to juice squeezed from freshly harvested fruit.

Another vending machine venture of promise stresses health value—dispensing six-ounce cans of orange, grapefruit or other fruit or vegetable juice for ten cents. Here, and in other avenues, the industry will find golden opportunities for extending markets for citrus juices while benefitting the health of the American public remarkably.

Time prevents indicating more than a few remedial measures which may be applied to improving the market for citrus fruits. It is not implied that those which are mentioned are more important than others, but rather that they are opportunities which impress technical men of the industry.

No method for improving markets can be neglected. Growers in all areas are in the same boat. What helps one helps all, what hurts one hurts all. Petty feuding is a luxury that can be ill afforded under existing conditions. If citrus consumpiton in Chicago doubles, every citrus grower in every area will benefit regardless of whether Chicago eats fruit from Texas, California, Florida or Alaska! The worst mistake that can be made is to waste promotional effort implying that some one else's fruit isn't as good as our own, because it creates a suspicion that none of it is too important. The fact is that the poorest citrus fruit is a far superior source of the food elements it supplies than the best other food available and relished in equivalent quantities.

Promotional efforts to date have been worthy of praise and blame, praise for such activities as handling of contacts with governmental agencies affecting this industry, blame for neglecting vast phases of the problem of improving citrus markets. However, the praise is due chiefly to competent leaders. The blame must go back on the growers themselves for not developing, supporting, and enforcing a complete program. Growers control the supply of fruit and until they use this control to prevent injurious practices, no agency and no leader can overcome all difficulties and insure a profit on their crops.

Second Demonstration Problem

Let us briefly consider the fact that the market for canned grapefruit juice has failed to absorb the pack for the past year. Surveying this situation: A few years ago when sugar was in short supply a season of sour grapefruit arrived. The canning industry put up a large pack. As a normal reaction public preference swung to canned orange juice which had been improved by new canning techniques.

Consumers liked sweet juice, and sales of canned orange juice mounted at the expense of grapefruit juice. The situation was aggravated when the market broke and canners, perhaps lacking interest in or understanding of the over-all welfare of the citrus industry, cut prices of canned orange juice to the same low levels as grapefruit, justifying their position by asserting that growers were willing to sell oranges below cost, permitting them to operate profitably and sell the product at the same low level as grapefruit juice. With no price differential, consumers climbed aboard the orange juice bandwagon. The grapefruit market was further demoralized, which in turn affected the orange market unfavorably.

In considering remedies for this situation, it should be recognized that retail differentials of two cents per 18 ounce can and five cents per forty-six ounce can are generally considered necessary to establish a consumer buying balance between these juices.

To improve the market outlook for canned grapefruit juice, growers must refuse to sell oranges at the same level as grapefruit. After a suitable price differential is enforced the problem of re-establishing and extending the habit of drinking grapefruit juice must be solved. Your speaker has discussed this problem with leaders in commercial

advertising and finds them unanimously agreed that the cheapest, and most effective means for establishing a food consuming habit is by means of contests, concentrated in desired marketing areas. Cereals have proven this repeatedly. Birds Eye is currently using this devise to establish eating habits for frozen ripe, freestone peaches, an exceptionally fine product. Libby is using it to stimulate the sale of slow-moving tomato juice. Grapefruit growers may well consider using it to re-acquaint the public with the pleasures and benefits of drinking grapefruit juice every day,—after they have forced a suitable price differential between this product and orange juice!

Third Demonstration Problem

The third problem selected to illustrate the needs of the citrus industry was the fact that distributors refuse to purchase stocks of canned citrus juices ahead of immediate requirements.

Applying the survey-analysis approach, we find that when citrus prices catapulted, distributors had just been stampeded into buying heavy stocks upon which they took losses that wiped out profits on citrus juice for several years.

Following upon the heels of this experience, buyers were treated to the spectacle of irrational price wars. Whether forced by the distress of underfinanced canners, or perpetuated by speculators, gambling that they could force growers to sell them fruit at their own terms, the disastrous effect of unpredictable price cutting was the same.

Buyers found themselves unable to consider canned citrus juices as staple foods subject to reasonable and nominal price swings. They were offered no choice but to consider them as speculative items subject to manipulation by a desperate or disorganized industry. Buyers cannot assume risks imposed by packers! Buyers who want to survive have no choice but to restrict purchases to immediate needs.

Canners can operate to better advantage and pay more for fruit when this situation is remedied. Whether growers can devise and apply controls to improve the situation remains to be seen.

Fourth Demonstration Problem

Before closing this sampling of problems of the citrus industry, it is appropriate to consider one of special interest in the field of Chemurgy. Dried pulp and final molasses, made from cannery residues, sell for less than inferior feeds.

Surveying this development; during the war when feeds were in short supply, buyers took dried citrus pulp and final molasses as rapidly as manufactured. These products are made from the peel, pulp and seeds remaining after canning operations. The mixture is ground with sufficient pure calcium hydroxide to almost neutralize citric acid. Juice is squeezed out in presses and concentrated to make molasses. The press cake is dried in kilns, bagged, and sold under the name: "Dried Citrus Pulp."

Analysis of the pulp shows a digestible carbohydrate content comparable to that of corn. In addition, the feed is rich in pectin, minerals and vitamins for livestock feeding. It has been used to advantage in beef and dairy cow feed and in pet and poultry feeds. The molasses has a number of constituents lacking in blackstrap molasses from the manufacture of cane sugar. It is well suited for cattle feeding.

Tests at Experiment Stations in several states have shown that, fed up to one fourth of the total ration, these feeds have exceptional value

(Continued on page 21)

The LYONIZER

Department

COMPILED BY THE LYONS FERTILIZER CO.

Reports Of Our Field Men . . .

POLK COUNTY
J. M. (Jim) Sample

During the past month growers have been very busy in this territory. They have been moving fruit, spraying, fertilizing and doing the many other chores that are to be cared for at this season of the year. We will have completed our summer application of fertilizer by the middle of June, and while there has been a tendency to use a somewhat smaller poundage, most growers have taken into consideration the fact that the summer application is very important in developing both the summer flushes of growth and the new crop of fruit, and have given their trees ample amounts of mixed goods that contained the necessary secondaries. As of this writing it is getting very dry all over the County and those growers that have irrigation facilities are using them to their limits. Large Valencia oranges are beginning to dry at the stem end and will have to be moved at an early date.

WEST CENTRAL FLORIDA
E. A. (Mac) McCartney

There are some valencias left in this territory but the bulk of the crop has been moved. We still have some grapefruit left on the trees but this is being moved at a rapid rate. Our summer application of fertilizer is well under way and will be completed by the middle of June. Most growers are giving their trees ample amounts of fertilizer to maintain them in good condition and where economy has been effected was in the reduced percentage of copper and manganese, with magnesium maintained at the recommended level. Vegetable growers throughout this territory have had a fairly satisfactory year with most of them realizing a profit from the season's operations. The strawberry growers are of course an exception to the above statement, as weather conditions ruined their crops at the peak of production. This territory had a fairly large acreage of watermelons and some growers with good crops made money. There were many plantings that failed to make a profit because of early disease infestations.

NORTH CENTRAL FLORIDA
V. E. (Val) Bourland

We are having plenty of hot weather and it is getting extremely dry in many sections with groves showing wilt. All growers that have irrigation equipment are watering their properties. In many cases citrus trees have shedded most of the young fruit but what hasn't been shedded is sizing up very nicely. Most groves in this territory have been sprayed with the usual copper spray program. Scale is showing up quite bad in most sections and it will be necessary to come in with a good oil spray at the earliest possible date. However the dry weather at present time is delaying this oil spray. Packing houses throughout this section are still running pretty regular with most of their pack being oranges. There is a world of grapefruit still on the trees, but this is dropping badly.

SOUTH POLK, HIGHLANDS & HARDEE COUNTIES
R. L. (Bob) Padgett)

Growers throughout this territory can boast of a very fine crop of oranges of all varieties that are growing off well and should make some excellent quality. In many cases the seedy varieties of grapefruit have a very light crop but there is a nice crop of marsh seedless. We are suffering from dry weather with many groves in a critical wilt that will probably cause the droppage of some fruit. There has been quite a bit of arsenic used this summer on early varieties of grapefruit with the hope of getting some early shipments to market - a program that over the season does not prove profitable. With groves suffering from dry weather a very favorable condition for red spider has been brought about and they are doing heavy damage in many groves. We have also had some heavy infestations of rust mite and growers have been busy getting these pests under control. Our summer application of fertilizer is well under way, and there is a definite tendency on the part of the grower to apply those mixtures that will result in better quality rather than more quantity.

HILLSBOROUGH & PINELLAS COUNTIES
C. S. (Charlie) Little

Getting water to the grove is the most important operation in this territory at the present time, as we are very dry and trees are wilting in most every section. Valencias are moving to market at a very slow pace and the grade is poor, causing a heavy loss throughout at the packing house. Most large sizes are showing dryness at the stem end. We have a good average crop of fruit set for the coming season on all varieties, and unless the present dry spell causes heavy droppage we should have a nice crop to move to market. Scale insects are bad as we have ever seen them and growers will have to use oil just as quickly as possible. This is one spray operation that is absolutely necessary as heavy scale infestations can cause much damage to the trees. Purple mite and red spider have been plentiful but are pretty well under control at this time.

SOUTHWEST FLORIDA
Eaves Allison

The new citrus crop seems too badly scarred in this territory from the long continued and heavy winds which blew down this way for about three months. Also, on many trees which bloomed heavily there is no sign of fruit. Winds or rain or something at the right time or the wrong time probably accounts for this condition. I have also noted a considerable drop of fruit on several large groves caused by infestations of mealy bugs under the calyx. The bug is pretty hard to reach here with even the most carefully applied oil spray, so the loss is heavy. Growers are going ahead with their summer fertilization as best they can in the face of the present low returns. Most are trying to give their trees a minimum maintenance amount of good fertilizer with sufficient secondaries to carry over. The vegetable deal has not been too bad in spite of tough growing conditions. Glad prices are up some at the end of the season, but most growers come out the little end of the hole.

'Member how last month we urged the growers of Florida to git together and stop quibblin' and do a real job of cooperatin' . . . well we noticed the followin' in Citrus News Flashes published by Ward's Nursery, Avon Park, which shows that we weren't the only one thinkin' along that line . . . the article reads: "Have you been watching the market prices of California oranges as compared with Florida oranges the last few weeks? It is admitted on the markets that the California fruit is not as good as the Florida fruit. Yet it is selling about $2.00 per box higher. This is chiefly due to well planned marketing and distribution, plus good, effective advertising. I wonder when the Florida growers, shippers and canners will get hurt enough and sick enough to all get together and try to do as good a job or even better job than California. The Florida Mutual may be the answer if it can be put over, but all will have to work hard to do it. It deserves study and should have the active support of all when certain adjustments are agreed upon."

The U. S. Atomic Energy Commission and the U. S. Department of Agriculture have announced that they're goin' to study the influence of radioactive materials on the growth of crop plants under the supervision of the Bureau of Plant Industry, Soils and Engineering . . . there's a three-way study goin' to be made: (1) to measure the effect of additions of radioactive materials to soil and fertilizers on growth, maturity, yield an dcomposition of various representative crops; (2) to determine the influence of low activities of alpha, beta and gamma radiation on the germination of seed and growth and vigor of seedlings; (3) to ascertain the influence of these materials on the number and activity of the bacteria and other soil microorganisms.

They's been 63 experimental plantin's under way since 1944 at agricultural and experimental stations all over the United States. Analyses of the results of these test plantin's indicates that minute quantities of radioactive materials applied to the soil affect favorably the yield of the crops and their size and quality of fruit and vegetables as well as the rate of maturity. In one case an increased yield of 92 per cent was reported. Best results so far has been with peas, cucumbers, tomatoes and sweet potatoes.

This is the season of the year when we make a mighty important application of fertilizer . . . the tonnage applied now will develop the flush of growth that will come durin' the next few weeks . . . it will develop the crop of fruit and to a big degree determine the amount of fruit that will be set next spring . . . the mixture applied now will also determine the quality of fruit that the grower will have to place on the market this fall and next spring . . . you'll find the Lyons Field Man glad to advise with you regarding the mixture best suited to your needs . . . feel free to consult with him . . . you'll find him helpful and courteous and glad to cooperate with you.

Uncle Bill

Bacteriological Survey Of Some Citrus Canneries In Florida

With Special Attention To Escherichia Coli . . .

ROGER PATRICK
U. S. Citrus Products Laboratory 2/
Winter Haven, Florida

At Meeting Florida State Horticultural Society.

Escherichia coli is an organism commonly associated with a certain type of bacterial contamination. The presence of **E. coli** should be given serious attention even though it is generally considered harmless because it is commonly found in the intestinal tract of warm-blooded animals. When this organism is present it is considered evidence of contamination, usually fecal, and indicates a health hazard. There is the danger that other bacteria capable of producing typhoid fever, dysentery, or other intestinal diseases may be present. The presence of **E. coli** in a food product may be determined by a series of simple tests. The American Public Health Association has recommended a standard routine check to determine the presence of **E. coli** in milk and water supplies and has been of great value in safeguarding the consumer's health. They have been a valuable aid in developing suitable sanitary measures so essential to healthful living. The results of routine analyses supported by differential tests as applied to citrus cannery equipment and unpasteurized citrus fruit products are presented in this discussion.

Samplings were made at ten citrus canneries in the Winter Haven area over a period of three years, Each plant was inspected at least once and several of them three times a season. The investigation included samples of the unwashed fruit, washed fruit, and of material from washers, conveyors, sizers, juice extractors, juice troughs, and juice blending tanks.

A brief description of the steps taken while making the search for **E. coli in** unpasteurized citrus products will be given. A known dilution is made with sterile water from the thoroughly agitated liquid portion of a sample. Petri dishes of eosin-methylene blue (E. M. B.) agar are inoculated with some of the diluted sample; observations are made at the end of 18 and 24 hours of incubation at 37 degrees C. Eosin-methylene blue agar is a selective medium. It is a mixture of lactose (milk sugar), other nutrients, and dyes. When **E. coli** grows on the surface of this medium, the dyes are incorporated with the cell growth, and a colony is formed that is distinctive in appearance for **E. coli.** The diagnosis of colonies grown on this medium requires a skill that may be developed through careful observations and comparisons with **E. coli** grown on the same medium.

Well isolated colonies are chosen for making bacterial suspensions in sterile water blanks from which lactose (milk sugar) broth and media for differential tests are inoculated. The differential test media and the purposes they serve are as follows: Tryptone solution, the first to be considered, is digested by **E. coli,** and indol is formed; the byproduct of growth is recognized as a color in solution when certain analytical reagents are added. Next in order is glucose solution which gives two differential characteristics. **E. coli** forms acid in glucose which is strong enough to cause methyl red indicator to turn red when added to the medium; the other characteristics sought for in this fermentation is the formation of acetoin. The Voges-Proskauer test is employed, and the reagents used cause a color formation in the medium when acetoin is present. The test is negative if **E. coli** has been grown in glucose. A medium containing citric acid as the only carbon nutrient present is the last in the series, and this medium will not support the growth of **E. coli.** These differential tests are known as the "Imvic" tests. Other differential media may be added to the list but these are considered the minimum number of tests to decide the absence of **E. coli** in a product.

A brief description of **E. coli** as gleaned from cultures on these media follows: The bacterium was a short rod. Spores were not formed. The test with Gram's stain was negative. Acid and gas were formed in lactose (positive reaction). Indol was produced. Methyl red reaction was positive in glucose and Voges-Proskauer test was negative. There was no growth on citric acid medium (negative reaction).

When these tests were applied to organisms found in citrus fruit products, **E. coli** was not found among the lactose fermenting, gram-negative, nonspore-forming rods. A summary of results for "Imvic" tests made during the last three seasons showed organisms representing six groups.

Many of the colonies selected from eosin-methylene blue (E. M. B.) agar plates resembled **E. coli** so closely that one with little experience would be inclined to call them coli positive. The experienced worker might be inclined to call them negative, yet would feel that it was very unwise not to proceed with differential tests. It was observed that these organisms formed colonies on E. M. B. agar much more slowly than **E. coli;** incubations usually required 48 and sometimes 72 hours.

These E. M. B. selected organisms and **E. coli** are very easily de-

1/ Agricultural Chemical Research Division Contribution No. 223.

2/ One of the laboratories of the Bureau of Agricultural & Industrial Chemistry, Agricultural Research Administration, U. S. Department of Agriculture.

stroyed by heat; therefore, a product that has been pasteurized would not show viable forms. **E. coli** inoculated into orange juice (acidity 0.7 per cent) at room temperature was not viable after four days. As the concentration of solids increased, the death rate of **E. coli** increased. At 31 per cent dry substances, as determined by the refractometer, viable **E. coli** was not found after 48 hours. The behavior of the unidentified E. M. B. selected bacteria almost paralleled that of **E. coli**. Grapefruit sections inoculated with **E. coli** and unidentified E. M. B. selected organisms were frozen and stored at sub-zero temperatures. **E. coli** was not found after eight days, but some of the other kinds were found after two months. The effect on viability of high-solid concentrations and citrus juice in sub-zero storage has not been investigated.

It would be interesting to know about the origin and distribution of these organisms that resemble **E. coli** so closely in appearance when grown in lactose broth and on eosin-methylene blue agar. Such knowledge might be a means of preventing economic loss to the producer when a hasty inspection would otherwise lead to the condemnation of his product and his plant sanitary program. Some thought has been given to this phase of the work, but a complete story cannot be given at this time. Many of these bacteria are known to live in soil normally, and one would expect that they enter the plant with the fruit. The surface of washed fruit has been checked for this type of contamination, but the tests were negative. The conveyor system was seldom found to be contaminated with these organisms, but the extractors and the juice collected at the extractors carried these bacteria almost invariably. Fruit flies **(Drosophila)** pass these organisms alive from their bodies, and it is possible that they contribute considerable contamination to the extractors when they are feeding on micro-plant life (yeasts and bacteria) and juice. Where the fruit flies collect the contamination distributed by them has not been determined. It is also possible that fruit which seems to be normal in outward appearance has sub-surface defects due to injuries and that the bacteria in question may come from such fruit which has begun to spoil.

This paper is a brief report on eosin-methylene blue (E. M. B.) agar selected bacteria collected from ten citrus fruit processing plants in the Winter Haven area. The investigation extended over three seasons. Each plant was investigated at least once, and some of them three times during the season. **Escherichia coli** was not found in the unpasteurized fruit product examined. The significance of the E. M. B. agar selected bacteria resembling **E. coli** has not been established. Additional work should be done to determine the source and significance of these bacteria in citrus fruit processing plants.

THE COMPLETE UTILIZATION OF CITRUS CROPS

(Continued from page 17)

as conditioning feeds, as illustrated by the quotation from one of the reports: "General effects were favorable as indicated by thrifty appearance, gloss of coat and improvement in thickness of flesh making it appear that this feed belongs in that group prized by stockmen for beneficial effects."

In analyzing the reasons for the current lag in the market for these two feedstuffs, we find that the products are new and are still suspect as "substitutes" for something else. Contributing to this attitude is the fact that if fed to excess, the pulp sometimes has a laxative effect. An additional factor to be considered is that the products are new, manufacturing methods vary and the products have not been standardized to a desireable extent. Molasses from one plant may react when mixed with that from another. Occassionally scale in molasses has clogged screens for mixed feed distributors. Some of the dried pulp contains black particles of unsightly appearance.

Suggested remedies: It is up to the industry to standardize products sufficiently to meet the needs of customers. This will mean that molasses will have to be made by processes which prevent fermentation of sugar content, to produce a product of uniform pH, free from insoluble particles which would clog screens. It will probably be desireable to pass all citrus pulp over screens to separate the "meal" from the "coarse pulp". For use in preparing dog foods, poultry foods, foods for fur animals and for pelletizing, the meal is best. For direct feeding to beef and dairy cows, the coarse pulp may be preferred.

After the products have been standardized as to quality and appearance, it will be desireable to develop, demonstrate and promote new uses. The final molasses is already established as the cheapest source of potable fruit spirits but the market for fruit spirits is limited. Syrup from late season fruit can compete with other available sources for industrial alcohol in today's markets and the supply of industrial alcohol is short.

Probably the most constructive thing the feed industry itself can do is to secure and exploit proof of the exceptional food values of these materials. This follows patterns established by other feedstuffs which have been introduced. Beet pulp went begging until pulp manufacturers bought cattle and sold their beet pulp in the form of beef in competition with beef produced on other feeds. It is conceivable that the citrus industry will have to resort to demonstrations of this type.

However, a first important step will be retaining a competent laboratory to make complete analyses of both the pulp and molasses, measuring such constituents as ascorbic acid, pectin, citrin, inositol, niacin, thiamin, riboflavin, pantothenic acid, folic acid, biotin, pyridoxin, and carbohydrates, fats, proteins and minerals.

The next step will be to make feeding tests on a wide variety of laboratory animals, fur animals, pets, poultry and livestock in such a research institution as that maintained by the Ralston Purina Company at St. Louis and at Grey's Summit. By endowing such a project the citrus

(Continued on next page)

THE COMPLETE UTILIZATION OF CITRUS CROPS

(Continued from preceding page.)

industry can establish the foundation for a sales campaign that will keep these feedsstuffs sold out at a premium.

The final step would be commercia demonstrations of feed-applications of exceptional promise. A striking demonstration in this direction is in progress at the Florida Range Cattle Experiment Station at Ona. Here, under the direction of Harold Mowry and W. G. Kirk, tests have been made on the value of citrus pulp Florida for fattening steers for market.

In these tests steers were pen fed for 120 days, making an average gain of about 2.2 lbs. per day. To produce this gain (feeding hay, cotton seed meal, and corn) each pound of gain required approximately:

Hay	2.7 lbs.
Cotton seed meal	1.3 lbs.
Ground corn	5 lbs.

When dried citrus pulp was substituted for corn the material required per pound of gain was approximately:

Hay	2.7 lbs.
Cotton seed meal	1.3 lbs.
Dried citrus pulp	3.7 lbs.

The costs of fattening was reduced from about 25 cents per pound to about 18 cents per pound! The quality of the beef was unimpaired!

In other tests whole fresh grapefruit or fresh grapefruit cannery residue was substituted for corn. The feed required per pound of gain was approximately:

Hay	2.7 lbs.
Cotton seed meal	1.3 lbs.
Grapefruit (fresh) (or cannery residue)	19 lbs.

On these feeds the daily gain dropped to 1.9 lbs. unless 1 lb. of corn was substituted for 3 lbs. of the fresh grapefruit. On either basis a saving of about 7 cents per pound of weight increase was still maintained, over feeding corn alone.

These results while preliminary, and subject to confirmation, suggest possibilities for diverting whole grapefruit, fresh residues and dried pulp into beef in Folirda for marketing. Whether similar savings could be effected in Texas could be determined by tests.

One thing that requires no testing is that prime fattened beef is easier to sell today than grapefruit.

(Concluded next month)

The world's population, now about 2¼ billion people, is increasing at a rate about 1 per cent, or 20 million a year.

Poor Citrus Tree Conditions

Texas Farming and Citriculture

There are areas in the Rio Grande Valley where citrus trees will grow and produce quite well with relatively little attention. In other areas attention is required. Generally a good deal of observation and foresight is needed to manage a citrus orchard successfully. Observation alone, however, will not give to the grower all the information which nowadays can be had for most profitable orchard management. There are conditions which the grower cannot see with his naked eye; which he cannot grasp by everyday experience. Nevertheless, these conditions are closely connected with profit or loss, as seen from the following possible cases:

(A) Too much salt may be the principal reason for early wilting, loss of leaves, small fruit, and if extreme, dead trees. The grower should, and can know his position regarding salts, whether they are increasing or moving out of his soil as time goes on.

(B) Available phosphate may be high in a particular piece of land. Applying more would be a waste of money.

(C) In another orchard or field high nitrogen reserves may be present in leaves or the soil. Further applications of nitrogen will not help, even though trees are unthrifty and foliage yellow. What is causing poor plant condition? The answer may require checking a number of factors. On the other hand a true lack of nitrogen or phosphate may exist. Knowing where and how much of different materials to use is money making information for any grower. Present day scientific methods can give every grower answers to these questions.

Classified Ads

CITRUS TREES for fall and spring delivery. All varieties. F. Gould Garcia, Box 843, Lakeland, Florida.

CITRUS TREES—Usual varieties and rootstocks. Accepting reservations for Fall 1948 and Spring 1949 delivery. Clay Hill Nurseries Co., Box 2880, Tampa, Florida.

CLEOPATRA MANDARIN Seed and Seedlings, also contracting for budded trees on Cleopatra.

RUBY RED GRAPEFRUIT and all standard varieties on lemon and sour stock. Grand Island Nurseries, Eustis, Florida.

FOR SALE — Two adjoining citrus groves: One 10 acres 21 years old, $12,000; the other 18.5 acres 15 years old, $18,000. Each has artesian well and planted to leading varieties of the Indian River Section. Terms or cash. For particulars communicate with owner Alfred Warren, Route 1, Box 212, Vero Beach, Fla.

WANTED—for our files, copy of Volume 2, Number 8 (August 1921) of The Citrus Industry Magazine. Anyone having a copy of this issue please mail to or advise Miss Eunice Weiderhold, Librarian, Citrus Experiment Station, Lake Alfred, Florida .

SUPERIOR CITRUS TREES for June planting on various rootstocks. Write us, stating the number of trees wanted of each variety and we will quote lump sum amount. Prices reasonable. Ward's Nursery, Avon Park, Florida.